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Solution to a 300-year-old zoological mystery: the case of Thomas Bartholin's merman

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ABSTRACT: In 1654 Dutch anatomist Thomas Bartholin published an illustration of a skeletal forelimb and a rib from an animal that had been caught off the coast of Brazil. Bartholin identified the specimen as a merman. Subsequent authors have hypothesized that it was a human with sirenomelia (fused legs). However, it is now acknowledged that mer-people are mythical and the drawing of the specimen does not match expected morphology for a human with sirenomelia. Until now, therefore, the correct identity of the specimen has remained unknown. Bartholin gave details on the specimen's size and added that before it was skeletonized the fingers were joined by a common membrane. We therefore compared Bartholin's illustration with the forelimb skeletons of west Atlantic marine animals of appropriate size in which the fingers are embedded in a flipper. The morphology of the specimen matches that of a manatee (*Trichechus* sp.) and is significantly different from that of the Caribbean monk seal (*Monachus tropicalis*) and from those of whales (Cetacea). The specimen was therefore a manatee, and a three-century-old zoological mystery is solved.

KEY WORDS : sirenomelia – Sirenia – *Trichechus* – cryptozoology.

The seventeenth-century Danish anatomist Thomas Bartholin (1616–1680) is best known for his contributions to human anatomy. He was the first to describe the lymphatic system. He also coined the term "wormian bones" for the intrasutural bones of the skull, recognized "tongue-stones" as fossil shark teeth, and wrote on such varied subjects as aneurysms and the history of obstetrics (Hill 2007). Among Bartholin's lesser-known contributions is the description of a specimen that he insisted was a merman[1], in a book on unusual anatomical cases (Bartholin 1654). Bartholin's friend Joannes de Laet (1581– 1649), director of the Dutch West India Company and an expert on New World natural history, gave Bartholin the specimen. It consisted of a forelimb and a rib from an animal that had been caught by merchants of the West India Company off the coast of Brazil and had been dissected in de Laet's presence by Pieter Pauw (1564–1617), superintendent of the anatomical theatre in Leiden. According to Bartholin's description (1654: 171),

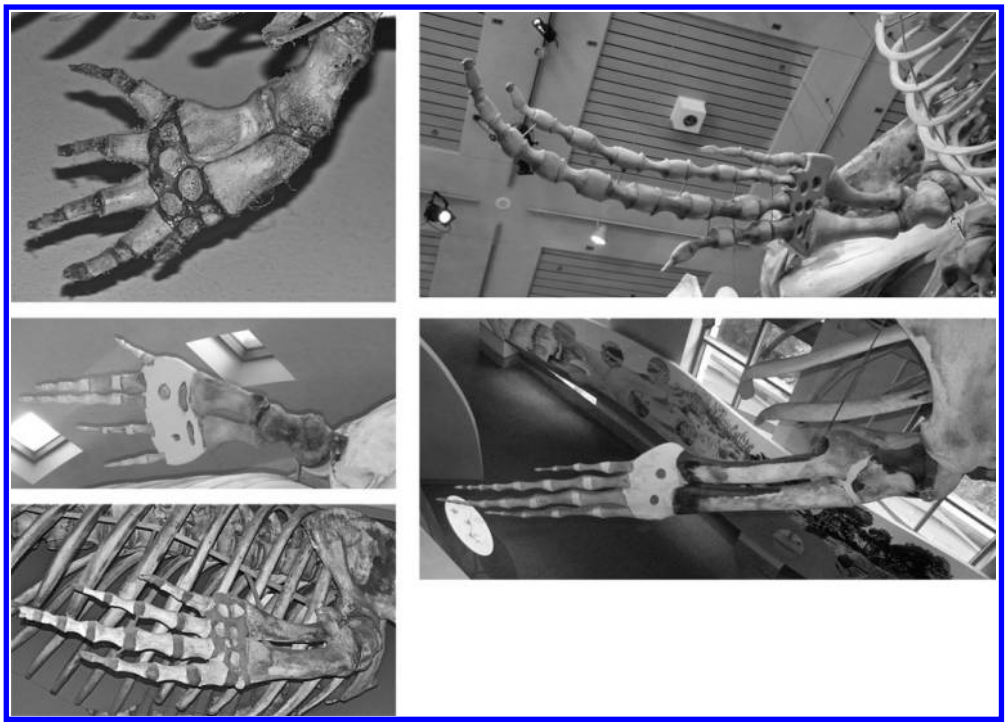
> The hand has five fingers, as in our own, and as many articulations as ours, but it is singular in that all the bones of the fingers and toes are wider and joined to one another in a common membrane, as in birds, such as goose, duck, etc., in which its [the membrane's] function is forward motion with the foot. The two middle fingers of the extremity are longest and pointed at the tips. The radius of the elbow [the forearm bone now known as the radius] is very short for convenience in swimming, barely four inches long. Nor was the shoulder more. The ribs are long and thick, almost surpassing those in the side of a common man.

Figure 1.Bartholin's (1654) illustration of the "merman" forelimb skeleton and rib, and fanciful reconstruction of the fleshed-out creature; the Latin labels for each drawing identify the reconstructed creature as a merman/mermaid ("sirene") and the skeletal parts as a hand (*manus*) and a rib (*costa*). Note that by adding small breasts, the artist has rendered the animal as female.

Bartholin (1654: 171) also mentioned that de Laet had told him that "from the chest to the navel it was of the human species, and from the middle to the other end it was lifeless flesh, without a tail." Bartholin concluded that the animal was a marine version of a human that confirmed old tales of mer-people. His illustration (Figure 1) included a drawing of the rib and the skeletonized forelimb with a fleshed-out reconstruction of the whole animal as he envisioned it.

In the eighteenth and nineteenth centuries, a plethora of alleged mer-person specimens made their way to Europe and North America from around the world. Those that were subjected to anatomical examination were usually revealed as taxidermic hoaxes consisting of the forequarters of a primate attached to the hindquarters of a fish (Dance 1976; Bondeson 1999). Amid this flood of mer-people into Europe, Bartholin's specimen is unique in a few important respects. First, it was not a taxidermic composite. Second, after dissection it was described as a real merman, not a fake. Third, its fingers were not separate like those of a primate but were embedded in a common membrane. Fourth, until now its true nature has remained unpublished.

Bartholin's specimen has been cited as an example of a human with sirenomelia, a developmental disorder in which the lower limbs fail to separate (Stocker and Heifetz 1987). The disorder is often called "mermaid syndrome". However, a diagnosis of sirenomelia is inconsistent with Bartholin's specimen. The disorder does not cause webbing of the fingers (Stocker and Heifetz 1987), whereas according to Bartholin (1654) the specimen's fingers were all joined in a common membrane. Also, humans with sirenomelia are usually stillborn or die in infancy due to abnormalities of the urinary system (Kallén *et al*. 1992). The intervention of modern medicine has enabled survival beyond infancy in a few recent cases[2],



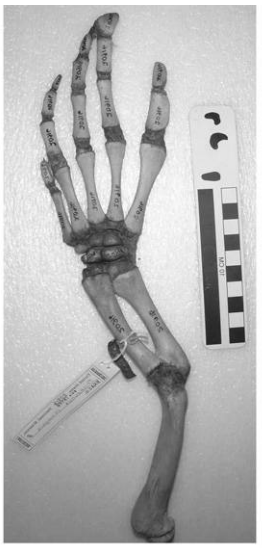
Figures 2–6.Forelimbs of cetaceans. 2 (left, upper) La Plata dolphin (*Pontoporia blainvillei*); note that several distal phalanges are missing, so the hand of a La Plata dolphin is longer than it looks here. 3 (left, middle) Bowhead whale (*Balaena mysticetus*). 4 (left, lower) Gray whale (*Eschrichtius robustus*). 5 (right, upper) Humpback whale (*Megaptera novaeangliae*). 6 (right, lower) Blue whale (*Balaenoptera musculus*). (Photographs by V. Snow (Figures 3, 5 and 6) and John Moch.)

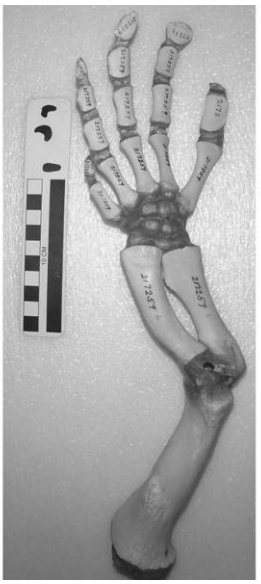
but in Bartholin's day no one with sirenomelia would have lived long enough to grow larger than a newborn baby. According to Bartholin (1654), his specimen had a radius four inches long and a rib as large as that of a common man and was therefore too large to be a newborn human.

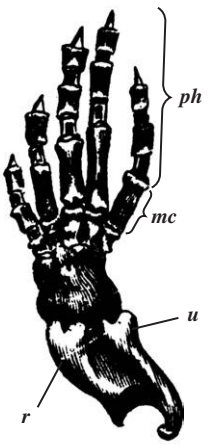
Several marine mammal species hail from the vicinity of the specimen's origin and have forelimbs with fingers that are united into a flipper. These include the West Indian manatee (*Trichechus manatus*), the Amazonian manatee (*Trichechus inunguis*), the Caribbean monk seal (*Monachus tropicalis*) – which is now probably extinct but was extant in the seventeenth century (Adam and Garcia 2003) – and several cetacean species. We compared Bartholin's illustration to the forelimb skeletons of *Trichechus manatus*, *T. inunguis*, *Monachus tropicalis* and various cetaceans, and we examined each of these taxa as a hypothetical candidate for the identity of Bartholin's specimen.

RESULTS

Cetacean forelimb skeletons differ strongly from Bartholin's specimen (Figures 2–6). The thumb in Bartholin's specimen is fully expressed, whereas the cetacean thumb is rudimentary or absent. In Bartholin's specimen each finger (phalanges only) is less than twice the length of its metacarpal, whereas the cetacean finger III – and in some cases







Figures 7–9.Forelimbs of marine mammals: 7 (left) Caribbean monk seal (*Monachus tropicalis*). 8 (centre left) West Indian manatee (*Trichechus manatus*). 9 (centre right) Amazonian manatee (*Trichechus inunguis*). (Photographs by Charley Potter.)
Figure 10(right). Bartholin's (1654) illustration of the forelimb skeleton of a merman ("Sirene"). Authors' annotations: ***mc*** = metacarpals; ***ph*** = phalanges; ***r*** = radius; ***u*** = ulna.

finger IV – is several times as long as its metacarpal. In Bartholin's specimen, the olecranon process of the ulna extends significantly more proximally than the proximal end of the radius, whereas in Cetacea the ulna and radius end proximally at about the same level.

The Caribbean monk seal's forelimb skeleton (Figure 7) differs strongly from Bartholin's specimen (Figure 10). The thumb in Bartholin's specimen is the shortest finger, and fingers III and IV are the longest, whereas in the seal the thumb is the longest finger, and finger V is the shortest. The ulna of the seal flares proximally into a very wide expansion, whereas such is not the case in Bartholin's specimen.

Bartholin's specimen strongly resembles the forelimb skeletons of manatees (Figures 8 and 9). The digital proportions of Bartholin's specimen are an approximate match for the examined manatee specimens. The shapes and proportions of the radius and ulna of Bartholin's specimen closely resemble those of manatees. Finger V of Bartholin's specimen curves toward the other digits, as in manatees. Furthermore, as in Bartholin's description, the radius of an adult manatee is about four inches long, and its ribs are longer and thicker than those of an adult human (Figures 8, 9 and 11). We therefore conclude that Bartholin's specimen was a manatee (*Trichechus* sp.) and the hypotheses that Bartholin's specimen was a Caribbean monk seal or a cetacean are incorrect.

DISCUSSION

It is now generally claimed that legends of the existence of mer-people were originally based on sightings of living manatees (Newton 2000; Eberhart 2002). However, Bartholin's claim

Figure 11.Mounted skeletons of an adult and juvenile West Indian manatee (*Trichechus manatus*) at the North Carolina Museum of Natural Sciences (Raleigh, North Carolina, United States), showing the relative lengths of the forearm and ribs. (Photograph by P. Sentner.)

of a merman was unique in that it was based on the osteology of a dissected specimen of a manatee and not on a sighting of an animal in the distance at sea. Arguably, either his conception of humanlike form included a wider range of morphology than most present-day minds would allow, or he was engaging in deliberate deception. Deception is unlikely, because seventeenth-century dissections were performed in the presence of witnesses so as to discourage false descriptions of findings by anatomists (Findlen 1994). It is therefore more likely that de Laet's conception of humanlike form was rather broad. If such was the case for seventeenth-century Europeans in general, it explains how they could regularly mistake manatees for mer-people despite the lack of resemblance of a manatee's face to that of a human by today's standards.

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NOTES

[1] Bartholin consistently referred to the creature as masculine.

[2] BBC News, 2006 "'Mermaid" girl's legs separated" (URL http://news.bbc.co.uk/2/hi/health/5325082.stm accessed 13 March 2013). Associated Press, 2013. "Shiloh Pepin dies at 10; girl with 'mermaid syndrome' " (URL http://www.latimes.com/news/obituaries/la-me-shiloh-pepin25-2009oct25,0,192127.story accessed 13 March 2013).

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